Vol. 9.] 1938. [No. 2.

AGRICULTURAL JOURNAL

Issued by the
Department of Agriculture, Fiji.

PRICE, ONE SHILLING.

BY AUTHORITY: G. W. COCKBURN, ACTING GOVERNMENT PRINTER, SUVA.
1938.

DEPARTMENT OF AGRICULTURE.

STAFF LIST.

ADMINISTRATIVE DIVISION—

Director of Agriculture (on leave)	Hon. H. W. Jack, M.B.E., B.A., D.Sc., M.L.C.
Senior Clerk	J. S. Rennie.
Clerks	E. J. Hart.
	Miss M. Garland-Matthews.
	J. M. Ramsay.
	Miss M. C. Walker.
	Miss E. Deighton.

VETERINARY DIVISION—

Senior Veterinary Officer (Acting Director of Agriculture)	C. R. Turbet, B.V.Sc., M.R.C.V.S.
Veterinary Officer	H. M. Stuchbery, B.V.Sc.
Stock Inspector (Temporary)	C. H. Köster.

RESEARCH AND LABORATORIES DIVISION—

Government Entomologist	R. J. A. W. Lever, B.Sc., (Hons.), D.I.C., A.I.C.T.A., F.L.S.
Government Chemist (on leave)	W. J. Blackie, M.Sc., F.N.Z.I.C., A.I.C.
Acting Government Chemist	P. R. Charlton, B.Sc.
Laboratory Assistant	G. F. Flemons.

LIBRARY AND PUBLICATIONS DIVISION—

Librarian and Editor of *Agricultural Journal*	R. J. A. W. Lever, F.L.S.

FIELD AGRICULTURAL AND PRODUCE INSPECTION DIVISION—

Agricultural Officers—	H. R. Surridge, A.R.C.Sc. (I)., B.Sc.
	B. L. Field, A.M.I.E. (India).
	D. A. Donald, H.D.A.
	B. E. V. Parham, M.A.
	L. W. Harwood, H.D.A.
Inspector of Produce.	A. B. Ackland, E.D.
Agricultural Assistants	W. L. Parham.
	S. E. H. Coster.

BANANA LICENCE BOARD.

Director of Agriculture (Chairman).

L. C. Bentley. Secretary for Native Affairs.

Inspector of Produce. J. A. Garnett.

Secretary, J. S. Rennie.

CONTENTS.

AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 9.] JUNE, 1938. [No. 2.

EDITORIAL.

IN the Editorial for the March issue it was stated that a loss of 50 per cent. of sugar cane had been estimated in Ba Province. This figure was later found to be too high for an average, such damage occurring in only a small area.

An article in this number which is likely to cause some local interest is that on the improvement of Fiji copra whose best grade (Plantation) on the world market is seen to be twenty-third out of forty, while a lower local type comes thirty-second on the list. This shows our place against competitors in Malaya, Philippines, Ceylon, East and West Indies, Zanzibar and various Pacific Islands and the case made for some form of minimum export standard, as has already been done in the Mandated Territory of New Guinea, seems well founded.

The Director's contribution on the control of rats as practised in Malaya should particularly appeal to coconut planters on Taveuni where Mr. R. W. Paine showed in 1934 that about thirty per cent. of the immature nuts are damaged by these animals.

The prosperity of the land waxes and wanes. On each wave of prosperity it is significant that animal importations increase. During the last three months many pedigreed stock have been imported. Noteworthy amongst these are the truly magnificent zebu cattle of the Brahmin strain of which two dozen have been imported from the United States of America to the order of the Colonial Sugar Refining Company Limited. A feature of these particular animals is their docility, in marked contrast to the impression which most of us have of the fiery disposition of this breed.

In response to a request for the West Indian thrips to be sent to the Solomon Islands to control Köster's Curse, a shipment was made in May. As there is over 25 per cent. difference in temperature between New Zealand and New South Wales on the one hand and Fiji on the other, the climatic factor is a major one but it is hoped the consignment will thrive.

DESTRUCTION OF RATS.

By
Dr. H. W. JACK, M.B.E., B.A., D.Sc., M.L.C.

SEVERAL requests have recently been received regarding the methods of destroying rats which prove destructive in rice fields, coconut estates, stores of rice, maize and all kinds of produce and in houses.

The following notes are designed to indicate some of the methods which proved successful elsewhere and it is hoped that they may be useful in Fiji.

Three methods of rat destruction have been used effectively, namely, trapping, poisoning and hunting. Poisoning consists mainly in the use of poisoned baits, but the injection into rat burrows of calcium cyanide dust or of carbon disulphide have also been useful.

I.—TRAPPING.

The persistent and methodical use of traps has proved to be one of the most satisfactory methods of destroying rats. Fuch's steel rat traps, of the guillotine type, have been found convenient and economical for this purpose. The various types of traps made in Malaya, mostly on the dead-fall principle, are also effective.

Baits for traps must be carefully chosen. If one kind does not prove attractive another must be tried. If trapping has to be maintained continuously, it is desirable to change the baits fairly frequently. Pieces of coconut, either alone or dipped in coconut oil and rice grains, have proved successful. In padi fields, padi (rice) grains are most commonly used, but dried prawn is also satisfactory. Baits should always be clean and fresh and should be handled as little as possible. Traps in which rats have been killed should be cleaned before further use and it is believed that traps dipped in coconut oil before being placed in position catch more rats than undipped traps.

Rats are intelligent and cautious animals to which the scent of their natural enemy, man, is often stated to be repellant. For this reason it is customary to recommend that the handling of baits should, so far as possible, be avoided and when setting traps, precautions should be taken to avoid or to mask the human scent. Such precautions are rubbing the hands in earth before handling the traps or dipping the traps after setting, in coconut oil.

II.—POISONING.

The poisons which are generally used are commercial sodium arsenite or barium carbonate. Experiments have also been conducted with the proprietary Zelio Paste.

(*a*) *Sodium arsenite.*—Various baits have been tried with this poison, but that which has proved most considerably satisfactory in the padi fields of parts of Malaya is made upon the following formula:—

Sodium arsenite ..	..	1 part by volume.
Rice polishings ..	..	4 ,,
Dried fish or prawn	..	1 ,,

Enough coconut or palm oil is added to bind the mixture into a stiff paste. A little water can also be added if necessary. The ingredients are thoroughly mixed and then rolled into small balls.

When a large number of such balls are needed they can conveniently and cheaply be prepared by the following method. The ingredients in the proportions given above are thoroughly mixed in an earthenware water jar,

the smaller size of " Shanghai " jar is suitable, and the paste in then passed through an ordinary culinary mincing machine, using the medium cutter. As the material is delivered from the machine it is sprinkled with rice polishings and rolled into balls by passing the hand over the mass once or twice with a circular motion. The balls are then placed in a gunny bag well sprinkled with rice polishings and rotated quickly up and down; finally the balls are laid on sacking to dry and set for about twelve hours, after which they can be safely transported in cases. The balls are preserved by the arsenic and will keep indefinitely.

The hands of the labourers engaged in preparing the baits should be well smeared with oil of aniseed before commencing work; by this means the human smell is masked and the baits are given an aroma which is attractive to rats. The scent rapidly disappears but can be renewed by introducing a few drops of aniseed oil into the case before use.

Arsenic is a very dangerous poison and should not be used in situations where it is easily accessible to children or domestic animals. For the same reason, labourers who have been handling the poison or poisoned baits should be made to wash their hands and arms very thoroughly as soon as they stop work. The stock of poison should be kept in a strong, locked receptacle.

The balls are easily dissolved by rain and for this reason should be put down in sheltered positions during wet weather, or inside short lengths of bamboo. The latter method has the added advantage of rendering the baits almost in accessible to most domestic animals. They may also be coated thinly with paraffin wax.

Another very effective form of bait is a grasshopper or dragon-fly. To prepare the bait the insect is caught and killed, its body split open and filled with a small quantity of poison. The insects thus prepared are placed in as natural a position as possible on clear parts of the bunds of padi fields or in conveneint places near the individual growing plants on estates. Rats seen unable to resist these insects and will take them continuously, apparently not becoming suspicious of them as they do of artificial baits.

Other baits which may be used are rice, padi or rice bran boiled and mixed with poison at the rate of six gallons of the bait to six cigarette tins of sodium arsenite. Alternatively, tapioca, sweet potato, rubber seeds, a mixture of bran and crushed prawn and also of bran and coconut fried with groundnut oil have been used as baits. No definite results from the use of these different forms of bait are recorded.

(*b*) *Barium carbonate.*—This poison is less dangerous to human beings than sodium arsenite. For use in poison balls, prepared in the same way as with sodium arsenite, the mixture is made on the following formula:—

Barium carbonate	2	parts by volume.
Rice polishings	4	,,
Dried fish, prawn or bran ..	1	,,

Coconut oil is added, with water if required. Barium carbonate can also be used in baits of grasshoppers and dragon-flies are already described.

Poison balls made with barium carbonate have to be used promptly, as this salt does not have the preserving action of arsenic and the balls soon become mouldy and develop an unpleasant smell.

Barium carbonate causes the poisoned rats to become thirsty and to search for water, so that dead rats are most commonly found in or near water.

(*c*) *Zelio Paste* is a proprietary preparation containing thallium sulphate. The quantity required to kill a rat is about 0·2 gram. When not fatal, the poison is stated to affect the reproductive organs, rendering them sterile.

Zelio Paste, spread on small pieces of bread, has been tried in buildings in Europe.

The paste has been made up into poison balls with the same mixture of rice polishings, dried fish and coconut oil as is employed with sodium arsenite with useful effects.

The following formula may be used:—Zelio Paste, 5½ oz.; rice polishings, 72 oz.; coconut oil, 10 oz.; dried fish, 8 oz., and a few drops of oil of aniseed being added. This mixture gives 800 baits.

In view of various objections and of the satisfactory results obtained by other methods, the use of any form of virus in this country is not at present recommended.

Effectiveness of poisons.—The chemical poisons described above are by no means rapid in their action and may require 24 hours or more to cause death. For this reason poisoned rats are able to move to some distance and hide in burrows or thick cover, so that a number of those killed are not found.

The comparative absence of dead rats often leads to a belief that the poison used is ineffective but this view should not be hurriedly accepted.

It must, however, be remembered that rats soon learn to recognise poisoned baits, especially if they are left about as they have to be when used on a large scale under field conditions. In wet weather most of those left uneaten probably dissolve and are washed away in a few days, but in dry weather they remain for some time and tend to increase the suspicion of the rats. Consequently, a new kind of bait should always be tried whenever it is fairly obvious that the bait in use is not proving successful.

Calcium cyanide dust.—Although this dust proves effective little use is made of it. It is so dangerous a poison, owing to the evolution of hydrocyanic acid gas, that its use has to be restricted to carefully trained labourers.

In some parts of Malaya rat burrows are common in the bunds of padi fields during the drier weather, and the injection of this dust or of carbon disulphide into them certainly kills a large number of rats.

Squilltox is a proprietary rat killer which claims to be harmless to other domestic animals and should be given a trial.

III.—Hunting.

The use of this method in padi fields should be organised in work to be effective.

IV.—General Observations.

Experience shows that in localities such as padi fields and coconut estates, where rat control has to be maintained continuously, reliance should be placed on intensive trapping and poisoning, aided by hunting when practicable. All such efforts must be sustained. Spasmodic efforts are useless and only result in a waste of money.

Rat control on coconut estates is assisted by the removal of any forms of cover such as jungle stumps and logs. Thick growths of close-growing cover crops afford cover for rats, provide in their seeds a plentiful supply of food and handicap all methods of rat destruction.

FACTORS INFLUENCING THE QUALITY OF COPRA IN FIJI.

By
L. W. HARWOOD, H.D.A. (Hons.),
Agricultural Officer, Islands.

On arrival in London copra is classified according to its country of origin, each country having its own characteristic standard of quality. Any disputes arising as a result of any marked depreciation of the recognised quality, heavy shrinkage, or any other such consideration are referred to the London Copra Association for settlement. In many cases, arbitration fees amounting to as much as five shillings per ton have to be paid by the loser and as a result of these decisions many shipments from this Colony are heavily penalized.

Table I shows that there is definite discrimination for quality and as the demand for high grade copra increases it is felt that the difference in the prices paid for good and bad copra will become greater. In this article it is hoped to point out the main reasons for Fiji's low position in the copra market and at the same time briefly to suggest remedies which it is thought would have an immediate influence on the quality of copra exported from this Colony.

The following table, which has been extracted from a pamphlet, entitled *Practical Aspects of Copra Deterioration* by F. C. Cooke of the Department of Agriculture, Straits Settlements and Federated Malay States, clearly illustrates the necessity for improvement in quality.

Table I.

Standard Copra Grades, 1937, *arranged in approximate order of relative price.*

			£	s.	d.
1.	F.m.g.w.s.	Malabar	*20	0	0
2.	F.m.s.	Ceylon	19	5	0
3.	do.	Seychelles			
4.	do.	Mauritius			
5.	do.	Jamaica	18	17	6
6.	do.	Trinidad			
7.	do.	Demerara			
8.	do.	West African			
9.	H.A.D.	Mozambique Plantation No. 1	18	15	0
10.	F.m.h.a.d.	Samoan Plantation (Crown Estates)			
11.	H.a.d.	Mozambique Plantation No. 2			
12.	F.m.s.	Java			
13.	do.	Straits			
14.	F.m.h.a.d.	Samoan Plantation			
15.	F.m.s.	Samoan Plantation	18	10	0
16.	F.m.h.a.d.	Rabaul Plantation			
17.	F.m.s.	Rabaul Plantation			
18.	F.m.s.	Papuan Plantation			
19.	do.	Dutch East Indies	18	7	6
20.	F.m.	Galle	18	5	0
21.	F.m.s.	Samoan Plantation			
22.	do.	South Sea Plantation	17	17	6
23.	do.	Fiji Plantation			
24.	do.	Standard Samoan (new grade)	17	15	0
25.	do.	Dutch East Indies (not Padang)			
26.	F.m.	Straits	17	12	6

* Nominal.

27.	F.m.s.	.. Mozambique			
28.	do.	.. Rabaul			
29.	do.	.. Samoan			
30.	do.	.. Papuan	£17	10	0
31.	do.	.. South Seas			
32.	do.	.. Fiji			
33.	do.	.. Zanzibar			
34.	do.	.. Philippine, Manila or Cebu			
35.	do.	.. Philippine			
36.	do.	.. South Sea Trade	17	5	0
37.	F.m.	.. Zanzibar			
38.	F.m.	.. Mozambique			
39.	F.m.m.	.. South Sea	17	2	6
40.	F.m.k.d.	. South Sea			

Key.

F.m.g.w.s. = Fair merchantable, good white sundried.
F.m.s. .. = Fair merchantable sundried or sundried
F.m. .. = Fair merchantable.
F.m.m. .. = Fair merchantable mixed.
F.m.k.d. . = Fair merchantable kiln dried.
H.a.d. .. = Hot air dried.

It would appear that the low price received for Fiji copra Nos. 23 and 32 is due to defects in quality resulting from faulty methods of production and marketing.

GRADES OF FIJI COPRA.

Two local grades are recognized by the London Copra Association, viz.:—

(*a*) F.m.s. Fiji Planatation, or as it is locally termed, Plantation. (23)

(*b*) F.m.s. Fiji which bears the local name of F.a.q. (32).

These grades are not the result of some carefully considered scheme of grading, and such essential requirements of the trade as colour, size of pieces, thickness, moisture-content, freedom from moulds and insect attack are not taken into consideration as they should be. As a natural consequence, distinct variations in quality occur and are anticipated by the buyers overseas.

(*a*) *F.m.s.* (*Fiji Plantation*).—This quality, listed as number 23 on the London market, is regarded as being the better grade, but whilst some parcels may be of very good quality, its principal defect is lack of uniformity. Copra in this grade may vary from good, clean, white sundried in big pieces to broken, mouldy, insect-infested, rancid, unevenly and insufficiently dried copra with a high free fatty acid content. In the absence of any grading system it is obvious that the quality of each consignment depends on the experience, policy and discrimination of the branch managers of the exporting firms.

Unfortunately, copra in Fiji, is not purchased entirely on a quality basis, and undue importance is attached to such considerations as tonnage supplied by the producer, volume of business done with the firm, reputation and other such factors, none of which should be of paramount importance. Under such circumstances there is little or no incentive for the smaller man to improve his quality.

The three main ports for the export of copra are Suva, Levuka and Savu Savu but owing to the bulk of the copra from the bigger plantations being shipped to Suva, the percentage of Plantation grade exported from there

appears to be considerably greater than at the other centres where the bulk of the Plantation grade consists of reconditioned copra and picked lots from the smaller suppliers. Copra which has been reconditioned cannot conform to the requirements of the trade and although the quality is appreciably improved by the re-drying, sieving, and re-bagging, it is obviously not comparable with good clean sundried copra which should constitute the Plantation grade. Copra, purchased and shipped as Plantation, has been inspected and graded by the writer, using the Malayan grading system, and in many cases, the grading has been Normal Kampong (53-60 marks) and Poor Estate (65–70). It is felt that copra of such quality should not be regarded as the premier grade of the Colony.

F.m.s. Fiji or F.a.q.—This is the second grade quality, and until very recently the greater proportion of the Colony's output has been of this type. It is represented as being a sundried grade but may include smoked copra from Wainunu, Natewa Bay, Taveuni and other parts of the group. Most of this type is supplied by the smaller planters, storekeepers and natives and on arrival at the port of export is often reconditioned.

Its quality is most unreliable, and may consist of copra light grey to blackish brown in colour, thin and broken in appearance, rubbery, possessed of a rancid unpleasant smell, heavily infested with moulds and insects, badly smoked or burnt, irregularly and unevenly dried and with an obvious excess of moist re and free fatty acid. A special gang of labour is required at each shed to recondition such copra.

Grading of Copra at Levuka.—For the past four months all copra coming in to the port of Levuka, has been graded by the writer and some interesting information obtained. As a result of these gradings, accurate records of the quality supplied by each shipper to this port are available. To date 303 samples have been graded on the Malay system, the results being as appended:—

TABLE II.

Marks	Grade.	Feb.	Mar.	April.	May.	Totals
90	Ceylon	..	..	..	1	1
85	Very Good Estate . ..	..	..	1	3	4
75–80	Malayan Estate	1	4	6	4	15
65–70	Poor Estate	1	15	25	7	48
55–60	Normal Kampong . ..	10	24	21	18	73
Under 50	Low Grade..	24	60	55	23	162
		36	103	108	56	..

Average Monthly Grade.

February	average marks per sample ..	= 44·17	Low Grade
March	do. ..	= 46·33	do.
April.	do.	= 50·23	do.
May	do.	= 56·96	Normal Kampong.

The steady improvement in quality is due to the middlemen taking more care in the manufacture of the product as a result of the stricter control of the purchase of "green" copra.

Mention might be made at this juncture of two samples of copra which were examined during February, one being from Wainunu, Bua and the other from Gau, Lomaiviti:—

(*a*) *Wainunu.*—This was supplied by a Chinese storekeeper and was slightly better than the average quality from this district.

Grading (Malayan system):—Colour 2, cleanliness 2, shape, texture, and appearance 2, smell 2, moisture 3 = 11 out of 20 = 55 marks out of a possible of 100.

Grade.	*Normal Kampong.*			
	Tons.	cwt.	qr.	lb
Weight of copra before sieving .. =	1	0	0	0
Weight of copra after sieving .. =	0	19	2	16
Weight of rubbish .. .. .. =	0	0	1	12
Per cent rubbish .. .. .. =	1·78			

Three sacks were returned to the producer, being considered unfit for purchase.

(*b*) *Gau:*—

Grading:—Colour 1, cleanliness 1, shape, texture and appearance 2, smell 1, moisture 1 = 30 marks out of a possible of 100.

Grade.	*Low Grade.*			
	Tons.	cwt.	qr.	lb
Weight of copra before sieving .. =	1	6	2	20
Weight of copra after sieving .. =	1	5	3	16
Weight of rubbish .. .. .. =	0	0	3	4
Per cent. rubbish .. .. .. =	2·95			

The two parcels examined were selected at random and are representative of the type of copra supplied by the average country storekeeper.

METHODS OF PRODUCTION.

The methods of production adopted by all types of producers could be greatly improved and it is in this phase of the industry that reform is most urgently required. Copra is manufactured by three distinct types of producers, viz.:—

(*a*) Planters;

(*b*) Middlemen, who purchase green copra from the natives and dry it on their own vatas or drying platforms;

(*c*) Natives.

The preparation of the meat for drying is the same in all cases—the nut is split in half with an axe, the kernel scooped out by means of a special type of knife, bagged and carted to the vatas or kilns to be dried. The drying facilities range from the modern steam and hot-air driers of the bigger plantations to the primitive arrangments of the natives and smaller storekeeper.

DEFECTS IN THE SYSTEM.

(*a*) *Local method of preparing the copra for drying.*—The main reason for the production of poor quality copra appears to be the local practice of cutting out the green meat in preference to husking and splitting as is done in other countries.

This pernicious practice has far too many demerits to mention them all but chief amongst them are:—

(1) The green meat is often left in the sacks for too long a time before being spread out for drying with the result that it sweats and ideal conditions arise for the growth of moulds.

(2) The copra is in small pieces.

(3) Apart from the inevitable losses in the field by careless cutters the meat is often brought into the vatas or kilns in a dirty condition.

(*b*) *Insufficient and unsuitable drying facilities.*—Many of the larger estates are well equipped with suitable kilns and running vatas by means of which a reasonably consistently good quality may be made. There are, however, plantations producing over 100 tons per annum where there is absolutely no provision for bad weather. Very few of the middlemen have any facilities other than the unprotected vatas which are covered with tin or coconut leaves at night and in wet weather. Some of these people have no vatas at all, in which case the copra is dried on the ground or on plaited coconut leaves. The average producer of this type seldom if ever cleans the vatas and until great improvements are made, good quality copra cannot be expected.

(*c*) *Storage conditions.*—These range from the well-designed copra shed of the big plantations to the primitive arrangements of the natives and some of the storekeepers. Many of the storekeepers possess excellently constructed, well-ventilated sheds, but others have Fijian bures* with earth floors, and there are traders who have no storage accommodation at all.

Table III, which is compiled from an inspection of green copra buyers' facilities in Vanua Levu, Taveuni and Lomaiviti, gives a comprehensive review of the conditions under which a very large percentage of the copra of this Colony is manufactured.

* bures = houses.

TABLE III.

SUMMARY OF GREEN COPRA BUYERS' DRYING AND STORAGE FACILITIES IN THE ISLANDS DIVISION.

Drying facilities.		*Storage accommodation.*	
Kilns	1	Iron or wooden shed with wooden or concrete floor and ample ventilation	113
Running vatas	25	Iron or wooden shed in bad state of repair and with insufficient ventilation	31
Open vatas with no protection for wet weather	119	Fijian bure with earth floor	18
No drying facilities	17	Fijian bure with wooden or concrete floor	3
Smoker	1	No storage accommodation	19
Open vatas and smoker	5	Iron shed with earth floor	2
Running vatas and smoker	4		
Running vatas and open vatas	14		
No. of stores	186	No. of stores	186

Estimated tonnage of copra produced per annum by the middlemen in the district, with drying facilities as shown above is 8,000.

(*d*) *Absolute dependence on sunlight.*—In certain of the wetter districts—such as Wainunu, parts of Natewa Bay, Savu Savu, and Taveuni—it is

practically impossible to produce good quality copra without some form of artificial drying. There is a marked difference in the humidity of the air during the day and at night, and in addition such factors as seasonal fluctations, alternating humid and dry days make it impossible to manufacture an even quality. Actual drying only takes place when the sun is shining; when the humidity of the air exceeds 80 per cent., as it does at night, the drying is stopped, and excellent conditions for the development of bacteria are present.

THE ACTIVITIES OF MIDDLEMEN OR GREEN COPRA BUYERS.

Approximately two-thirds of the output of this Colony, is grown by the natives and a very big percentage of this is purchased as green copra and dried by the country storekeepers.

Eight hours is the maximum time that should elapse before the green meat is put on the vatas or kilns, but much of the green copra purchased by these traders spends considerably more time than this in the bags. Moreover, the average trader has insufficient drying space to cope with a rush consignment of copra with the result that there are invariably sacks of green copra lying on the verandah of the store. To make space available for fresh copra, the half-cured product is often taken off the vatas and mixed with the dry copra in the shed. On such occasions as these copra is dried on the verandahs and roof of the store and even on the ground In addition, the storage accommodation for the dried copra is invariably inadequate and absolutely unsuitable.

DAMAGE BY BIRDS AND DOMESTIC ANIMALS.

Where copra is dried by means of running or open vatas considerable damage is done by the depradations of such birds as mynahs and poultry, while pigs also do their share.

OVERLOADING.

This is a very common fault, particularly amongst the storekeepers, and results in moulds forming rapidly. Care should be taken to see that there is room on the drying vatas for the free circulation of air.

SMOKE CURING.

In some of the wetter districts, producers have resorted to the old method of smoking copra. The kiln used is an adaption of the small copra drier introduced by the Department of Agriculture and the mis-use of these kilns has lead to the alarming percentage of badly smoked and half-dried copra which is now being offered. This type of copra is definitely increasing and much of it is of very low grade being dark brown to black in colour, badly case-hardened and containing upwards of ten per cent. of moisture, although this is now shipped as a special grade, a certain percentage of it is shipped as F.m.s. Fiji or F.a.q. and arbitration claims are imposed. Most of this copra comes from Wainunu and parts of Cakaudrove.

SECOND-HAND SACKS.

A big proportion of the native and small traders' copra is sold in insect-infested second-hand sacks which are never cleaned or fumigated.

DIRTY STORAGE ACCOMMODATION.

Copra is stored in dirty copra sheds which are invariably insect-infested These could be cleaned and fumigated more often with advantage.

IMMATURE NUTS.

Immature nuts produce rubbery copra, which is particularly liable to deterioration.

MARKETING.

(*a*) *Grading system.*—The most regrettable aspect of the marketing of copra from Fiji is the absence of any system of grading. In these days of increased production and competition of other oils it is becoming increasingly difficult to obtain a satisfactory price for copra of unguaranteed quality. Attempts made to establish compulsory grading only resulted in a form of voluntary grading. This has never been put into operation as it was obviously unsuitable.

No certificate of quality stating the percentage of oil, moisture, and free fatty acids present accompanies shipments of copra overseas, consequently any good parcel of copra is subjected to the same close scrutiny as is given to the obviously poorer grade.

The Mandated Territory of New Guinea introduced a system of compulsory grading with the result that the price received for the copra increased appreciably. It has been argued that the cost of grading would be prohibitive but experience in other countries prove that whatever expense is incurred is justified. Government should set the grades and it would be only a matter of time before the quality of copra would improve. Under the present conditions merchants cannot afford to refuse poor quality copra as it will find a market with rival firms but if there were a system of grading these conditions would not exist.

(*b*) *Handling of copra at the port of export.*—Many consignments of copra from the bigger plantations purchased at plantation price are not even inspected at the port of export, the reputation of the supplier being considered sufficient guarantee of quality. This practice is reasonably safe where the estates are provided with artificial driers, but when the copra is sun-dried the grade is variable.

(*c*) *Prolonged storage of copra.*—As a result of unreliable shipping facilities and fluctuations in price, copra is often stored for lengthy periods on estates and at country stores. This practice is to be deplored as it results in heavy losses as a result of mould action.

(*d*) *Shipping.*—Copra from the outlying parts of the group is brought to the port of export in small cutters and on occasions damage is caused by the shipping of heavy seas. These bags of wet copra act as centres of decay.

CONCLUSION.

It may be safely stated that the poor quality of copra exported from Fiji is due to defects in quality caused by careless methods of manufacture and unsuitable marketing conditions. It is obvious that before the quality of our copra may be improved drastic changes must be made and it is thought that some of the following suggestions may be practicable:—

1. Whole-hearted co-operation between all classes of the copra producers to improve their drying facilities, storage accommodation and methods to improve their drying facilities, storage accommodation and of production.
2. The establishment of some suitable form of grading.
3. Improvement in local shipping facilities.
4. Rigid enforcement of those sections of the Copra Ordinance which prohibit unsatisfactory methods of copra-making and the compulsory improvement of the middlemen's drying and storage facilities.

NEW BANANA VARIETIES FOR FIJI.

By
B. E. V. PARHAM, M.A.,
Agricultural Officer (Plant Pathology).

In January, 1936, by courtesy of the Principal, Imperial College of Tropical Agriculture, Trinidad, the Department of Agriculture imported four banana types for trial in Fiji.

Three of these were types belonging to the Cavendish Group which had been classified by Professor E. E. Cheesman in 1933 as follows:—"Giant Chinese" (Type 3); Congo (Type 4) and Lacatan (Type 5). These are regarded as related forms of one genetic group which have arisen possibly as bud mutations (1) and the desirability of their introduction to Fiji was twofold.

In the first place it was considered that no effort should be spared to obtain and test out banana varieties of commercial value which under Fiji conditions might be more resistant to the local banana diseases "Leaf spot" and "Bunchy-top" virus. Secondly, the identity of the local variant known as "Veimama" has long been in doubt and as plants of this variety could not be sent to Trinidad for study for fear of introducing the Bunchy-top virus disease to the Carribean area it was decided to introduce known types of the same group for the purpose of comparative study under local conditions.

The fourth type introduced was one of great interest, namely, the hybrid known as I.C. 2., produced in the course of banana breeding experiments at the Imperial College of Tropical Agriculture. (2) This banana is the result of a cross between Gros Michel and a wild seeded banana (*Musa acuminata*) and its great advantage is its resistance to Panama disease. Owing to the shortness of the individual fingers, the fruit of this hybrid was not considered entirely satisfactory for bunch shipments but it appeared to have possibilities for case shipments. After careful preparation by Professor Cheesman during 1935 the corms were shipped in December and reached Suva on 14th January, 1936.

They were planted in an isolation insectary at Suva and kept under observation for eight months. In August, 1936, they were removed to the Central Agricultural Station at Naduruloulou and planted in a specially selected site for further observation.

The numbers of suckers transferred at this time were as follows:—Giant Chinese 1, Congo 2, Lacatan 2 and I.C.2. 11. The growth of the plants was good and all the stems fruited during 1937 as shown in the following table:—

Variety.	Number of bunches.				Total weight. Hands.	Average per bunch	
	7 hands or less.	8 hands.	9 hands.	bunches.		Hands.	Weight.
					(lb)		(lb.
I.C.2.	10	3	..	13	518	7	40
Giant Chinese	..	..	2	2	98	10	49
Congo	1	3	2	6	224	8	37
Lacatan	2	3	..	5	126	8	42

The plots were situated on hilly land with a shallow soil overlying red clay; contour drains and cover crops of *Calopogonium mucunoides* and Cowpea were utilized to retain the surface soil. Moreover, as the plants

FIG. 1.—Hybrid Banana I.C. 2. at Central Agricultural Station, Naduruloulou. Note absence of "Leaf spot" Disease.

FIG. 2.—VAR. "GIANT CHINESE"—I.C.T.A. TYPE 3.

FIG. 3.—VAR. "CONGO". I.C.T.A. TYPE 4.

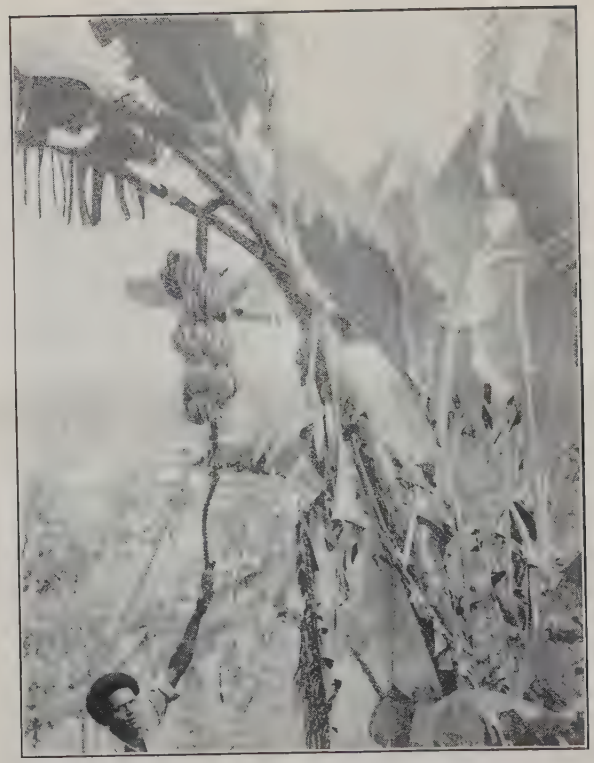

FIG. 4.—VAR. "LACATAN"—I.C.T.A. TYPE 5.

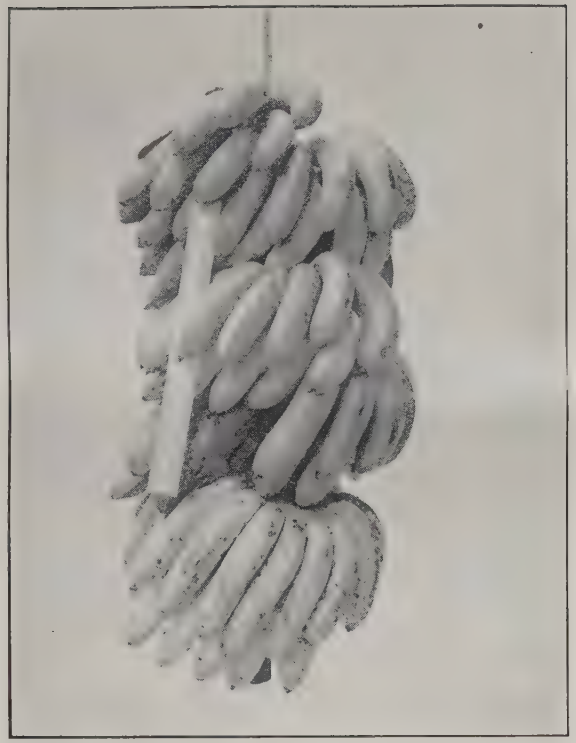

FIG. 5.—HYBRID BANANA I.C. 2. RIPE BUNCH.

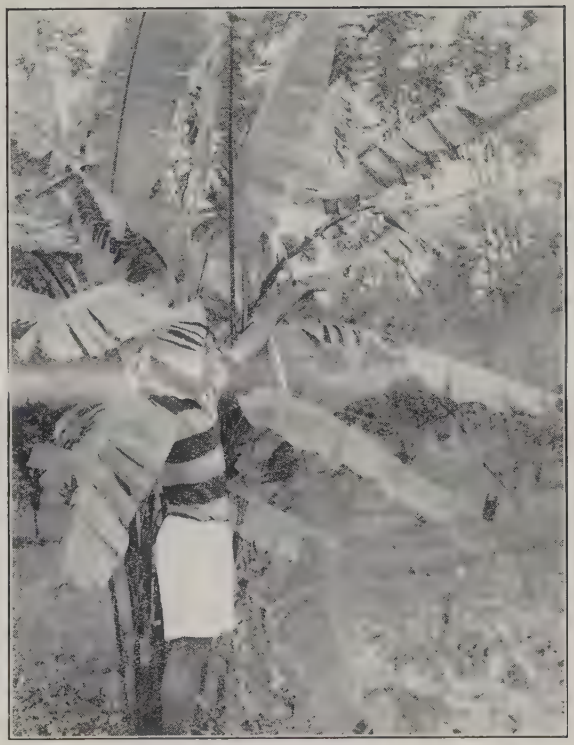

FIG. 6.—SEEDLING BANANA (*Musa acuminata*).

were required for propagation, no pruning was undertaken with the result that the I.C.2 plants soon developed a large mat comprising up to 6 or 8 stems.

In September, 1937, suckers were removed as follows:—I.C.2, 72 to propagation plot on good alluvial soil, Lacatan 12, Congo 12 and Giant Chinese 6 to a plot for comparison with Veimama and Cavendish (local) types.

The following brief notes are of a preliminary nature but may be of interest.

I.C.2 (Figs. 1, 2).—This variety has very much the habit of Gros Michel and attains a height of 18 feet. The stems are very robust (47 inches diameter at the base) but the leaf midribs frequently break half way, causing one half of the leaf to drop. The petiole wings are tinged with red and the young leaves carry the characteristic blotches of Gros Michel.

The resistance of this variety to the leaf-spot disease (*Cercospora musæ*) is notable and an important point in its favour.

The leaves are commonly infected with rust (*Uromyces musæ*) and speckle (*Chloridium musæ*) and the plant is definitely susceptible to buchy top virus, three of the original stools succumbing to this disease. The bunch is rather small and does not hang quite vertically, the fingers are straight and short and lack the pointed end characteristic of Gros Michel (Fig. 2). Up to date the largest bunch produced has been of 8 hands weighing 55lb, while the average, as shown in Table 1, is 7 hands of 40lb.

The fruit ripens under ordinary conditions to a very bright yellow and the flesh is firm and white with a very sweet flavour. The skin does not develop the black maturity spots common in Cavendish and Veimama.

Giant Chinese (Fig. 3).—This plant appears to be a very robust type of Cavendish and attains a height of 8 feet with a basal girth of 33 inches. It appears identical with a local type known to the Fijians as " Jiaina leka balavu " (*i.e.*, Tall Cavendish) and bears a close resemblance to the type known as " William's Hybrid " in Queensland. The bunch is large—ten hands (49lb)—and the rachis* is clothed with the undeveloped neuter flowers. The fruit is typical of the Cavendish type, with the same ripening characteristics. The variety is susceptible to *Cercospora* leaf spot as may be seen in Fig. 3.

Congo (Fig. 4).—This plant is of medium stature, 10 feet, and is very similar in appearance to the local " Veimama leka." The stems are robust (35 inches basal girth) and the bunches of good size, 8 hands, weighing up to 40lb. The rachis is naked.

Lacatan (Fig 5).—This is taller than the " Congo," attaining 10 to 14 feet in height. It is not to be distinguished from " Veimama Veimama " of the Fijians and produces a typical " Veimama " bunch averaging 8 hands of 42lb.

It is equally susceptible as local types to *Cercospora* leaf spot and bunchy top virus, one of three stools being completely destroyed by the latter disease.

These plants are being studied more fully—and are expected to produce heavier crops when grown under more normal conditions and in better soil. Trials for their behaviour under transport conditions as case fruit are being undertaken, two cases of I.C.2. have been shipped to New Zealand with satisfactory results.

Early in 1937 a fifth type known as " S 19 " was introduced from Jamaica. This is another hybrid of Gros Michel and is resistant to Panama disease. As the plants are still in quarantine it has been impossible as yet to study their behaviour under field conditions.

Seed of the following varieties forwarded by Professor Cheesman were sown without much success, only one seedling being raised, *Musa acuminata*, *Musa basjoo*, " Calcutta 4," and *Musa brachycarpa*. Fig. 6 illustrates the first bunch thrown by the seedling plant (*M. acuminata*), which up to the present has proved resistant to *Cercospora musæ* (Leaf spot). The characteristic pose of the bunch and the pointed terminal bud may be noted. This plant is of interest as having provided the male plants used in cross pollination which resulted in the production of I.C.2. The small fruit is packed with large hard seeds.

REFERENCES.

1. Cheesman, E. E.—" Banana Breeding at the Inperial College of Tropical Agriculture "—Empire Marketing Board Report No. 41, 1931.
2. Cheesman, E. E., Wardlaw, C. W., and Spencer, G. L.—" The Cavendish Group of Banana Varieties with special Reference to Lacatan."—*Tropical Agriculture*, Vol. 10, No. 8, 1933.

* Rachis is the terminal axis of the bunch.

ENTOMOLOGICAL NOTES.

By
R. J. A. W. LEVER, B.Sc. (Hons.), D.I.C., A.I.C.T.A., F.L.S.
Entomologist.

A.M.L.

1. TWO PALM BEETLES FROM EASTERN SAMOA.

THE island of Tutuila in Eastern or American Samoa appears to be the most easterly point where the coconut leaf-miner, *Promecotheca reichei* Baly, is reported.

During a day's visit to Pago Pago on the 9th April, 1938, the writer found adults and mines of this insect on an ornamental fan-palm, *Pritchardia pacifica* Seem. et Wendl. This seems to indicate that the beetle is becoming more abundant as Buxton (1) and Hopkins (2), who stayed in the islands for two years in 1923–25, looked carefully for it in many parts of Samoa but found it only on Upolu, Western or New Zealand Samoa, on coconut, where it was " unexpectedly uncommon." Specimens were taken however in 1918 at a height of 1,000 to 3,000 feet on Tutuila, which shows that the beetle has come down to sea-level within twenty years. It ranges from Fiji (particularly in Lau), *via* Uvea (Wallis), Futuna and Alofi (Horn) to Tonga and Samoa. Other species, on palms and wild ginger, are found from New Caledonia, through the New Hebrides, Banks and Solomon Islands to New Britain and New Guinea and a second species occurs in Fiji.

The dreaded Asiatic rhinoceros beetle, *Oryctes rhinoceros* L., reached Upolu, Western Samoa, in 1909 (3) although most sources give November, 1910. The first record for Eastern Samoa appears to be Swezey (4), who visited the Group in 1923. In April, 1938, the writer saw the typical damage to the leaves in palms only a few hundred yards from the shore at Pago Pago harbour, which, occupying as it does the floor of an extinct volcanic crater, rises very rapidly indeed from the beach so that only a short flight is needed to reach vessels anchored close to the town.

REFERENCES.

(1) Maulik, S., 1929.—*Insects of Samoa*, Part 4, Fasc. 3, British Museum, London.
(2) Hopkins, G. H. E., 1927.—*Bull. Entom., Res.*, Vol. XVIII.
(3) Moors, H. I., 1913.—*Tropical Life*, March.
(4) Swezey, O. H., 1924.—*Hawaiian Planters' Record*, Vol. XXVIII.

2. FRUIT FLY PARASITES: INTERIM NOTES.

The former Government Entomologist introduced, through the courtesy of the Hawaiian Sugar Planters' Association, two parasites for controlling the local fruit flies, *Chætodacus passiflorœ* Frogg. and the scarcer *C. xanthodes* Broun. In April, 1935, the African *Tetrastichus giffardianus* Silv. was liberated and in March, 1937, a robust Indian species of *Dirhinus*. These take respectively 15½ and 20 days to develop within their hosts.

In March and April, 1938, the Government Entomologist of New South Wales, kindly forwarded to the writer stocks of a small (1·5 to 2mm.) Indian parasite *Syntomosphyrum indicum* Silv. which was first transported to Italy and Sicily in 1907 and next year to South Africa and Western Australia(1). It is of interest to note that, despite the considerable difference in temperature between Italy and Fiji, the parasite takes the same period (15 to 16 days) to develop inside the host larvæ and pupa in Italy as in Suva. This parasite has been liberated in various parts of Viti Levu Island and a parasitism of 25 per cent. has already been obtained from larvæ collected from guava at Samabula, where the first liberation was made.

The two local Braconid parasites mentioned by Simmonds (2) are *Biosteres* sp. and *Opius fletcheri* Silv., the latter having an ovipositor twice as long (2 mm.) as mentioned by Simmonds. Specific identification of the former parasite is awaited from the Imperial Institute of Entomology, but a preliminary notice of a third local Braconid—a small dark brown parasite measuring 2 mm. in length—is mentioned in this interim report.

Further notes dealing with the hosts and the biology and development of the parasites will be published later.

(1) Silvestri, F., 1914—Bull. No. 3 Dept of Agriculture and Forestry, Hawaii.
(2) Simmonds, H. W., 1935—Bull. No. 19 Dept. of Agriculture, Fiji.

3. TIMBER-BORING BEETLES.

Few references are available concerning the smaller timber-boring beetles of Fiji and the only local records appear to be the "shot-hole" borers *Xyleborus perforans* Woll., which mines in coconut trunks and in kauri timber in Santa Cruz in the Solomons; *X. morstatti* Hag. which does similar damage to avocado pear branches, and finally some members of the family Bostrychidæ.

Through the kindness of the Conservator of Forests, two further boring beetles have been recorded, viz., the larger *Platypus gerstaeckeri* Chap., which is 7 mm. long and a small Scolytid beetle measuring only 2 mm. in length. Both insects were taken at Nadarivatu, Viti Levu, in the wood of *Podocarpus vitiensis* Seem. ("dakua salusalu") and *Endospermum* sp. ("kauvula").

The damage, which is nearly always made in green timber, consists of a main burrow from which larval galleries are made at right angles. Although it is the timber which is thus injured by the insect's activities, the food is a black fungus in the mines and to this has been given, somewhat inappropriately, the name of ambrosia, so that the insect is called the ambrosia beetle.

Lands Department, Suva.


180°
179°
178°
Undu Pt.
Lighthouse
Ndrua
VISONGO
Nggelelavu
Nukumbasanga
TO VANCOUVER VIA HONOLULU
TO SAN FRANCISCO VIA SAMOA AND HONOLULU
Kumbulau Pt.
Rambi
Thombia
Yanutha
KIOA
Mbutha B.
WAIYEVO
(Radio)
LAUTHALA
NGAMEA
TAVEUNI
Wailangilala
Lighthouse
Vuna Pt.
SALIALEVU
NAITAMBA
17°
Bay of Islands
Avea
Vanuambalavu
Thikombiailau
YATHATA
Kaimbu
KANATHEA
LOMALOMA
Susui
MUNIA
Vatuvara
Mango
LAU
Katafanga
UVUTHA
Yaroua
Thithia
NAYAU
Bacon Id
Vanuamasi
18°
Lakemba
Aiwa
VANUAVATU
GROUP
ONEATA
Olorua
Komo
MOTHE
Karoni
Moala
WANGAVA
NAMUKAILAU
Nayutuira
Yangasalevu
Nayutuiloma
Totoya
Kambara
Marambo
Matuku
Fulanga
ONGEALEVU
Ongeandriki
19°

As unhealthy trees suffer most it is recommended to fell these first and stack the logs for the minimum time before transport. Circulation of air in the stacks should be practised where possible, the bark removed and the logs painted with hot creosote or other available mineral oil. The necessity for the disposal of " slash " and discarded timber is obvious as both are attractive to these and other insects.

4. EXPORT OF THRIPS TO THE SOLOMON ISLANDS FOR CONTROLLING *CLIDEMIA*.

Although the sunbush or Köster's Curse, *Clidemia hirta* Don., is believed to have been in the British Solomon Islands since about 1929, it was not until 1936 that it was officially reported (1). It was then suggested by the writer that the West Indian thrips (*Liothrips urichi* Karny), which had been introduced successfully from Trinidad to Fiji in 1930, might be brought into the Solomon Islands for the same purpose.

Experiments with a flame-thrower in October, 1936, on Shortland Island were not encouraging (2) as the plants recovered from the first treatment and the price of the cheapest crude oil available rendered uneconomic the second application which was needed. Although some damage was done by a small weevil, *Trigonops* sp., which eats holes in the leaves, this did not constitute a control.

Accordingly, in May, 1938, a number of caged *Clidemia* plants, heavily infected with *Liothrips*, was dispatched from Fiji *via* Auckland and Sydney to the Solomon Islands. As the temperature in Suva in May and June averages 75° F. and in Sydney is 55°, it is subjecting both the plant and its parasites to an unfavourable environment, but other factors made the time chosen by the interested Company a convenient one.

It is interesting to note that Simmonds (3) found in Trinidad that if the nymphs were placed in a closed tin with dry and fresh leaves they deserted the former for the latter. The writer's experience in Fiji, however, was that neither nymphs nor adults would forsake leaves brought from the field and laid on growing *Clidemia* plants. The insects had to be removed one by one with a needle or paintbrush to prevent their death as they remained at the junction of the main veins of the original leaves, even when these were perfectly dry and brittle. This difference in habit is attributed to the necessity for the insects to be on the lower surface of the leaf which they can easily reach in a confined space, but when laid in contact with the upper surface of the leaves they fail to crawl to their ideal conditions which are awaiting them on the other side.

At present this plant is confined, in the British Solomon Islands Protectorate, to Shortland Island and some of the small islands immediately surrounding it. This region has a rainfall of 145 inches, which is about 25 inches in excess of the average for Suva, but it is hoped nevertheless that the introduction will be a success once the plants reach the Solomons after an enforced experience of a week in Australia's winter.

(1) Lever, R. J. A. W., 1936.—Brit. Solomon Is. Agric. Gaz. Vol. III, No. 4, Supplement.
(2) Lever, R. J. A. W., 1937.—Bulletin of Entomological Research, Vol 28, Part 2.
(3) Simmonds, H. W., 1934.—Legislative Council Paper, No. 5, Fiji, Appendix A.

MYNAH BIRDS.

By
B. LYON-FIELD,
Agricultural Officer, North.

The common mynah, *Acridotheres tristis*, is a brown bird with yellow chops, yellow beak and legs, brownish eyes, a black head, neck and throat and black and white feathers in the tail. The wings are brown with a few white feathers, and the breast is not lighter in shade than the back. This bird is known as the plain mynah as it is found on the plains of Southern India and is distinct from the hill mynah. The brown mynah is insectivorous and carnivorous, eating any meat scraps and bread or pecking at fruitskins with evident relish. It builds in the roofs of houses and under the eaves on top of verandahs and louvres, making a large untidy nest of twigs, grass, paper and even pieces of material; for it is bold and will fly into a room and get away with pieces of paper. They are ,at times, money-grabbers, for currency notes missed from a table were found in a nest. They are persistent builders, for if the nests are pulled down when building, they will return to the same spot and start again two or three times if necessary. Apparently they return to the same nesting places each year, though without putting identification rings on the birds, there is no definite proof of this. The same thing applies to the impression that they have two clutches during the breeding season. Certainly after the hurricane of 1931 on Viti Levu, when so many of the birds were killed, those that remained set to work to reproduce more of the species; and it is thought that there were definitely two nestings that year. The nesting season is from October to January. Albinos have been seen but they appear to be outcast by the others; one, in particular, was watched for three successive years.

The field mynah, *Acridotheres ginginianus*, of the plains of Southern India is quite distinct from the hill mynah of India which is larger, jet black with large orange wattles and is an excellent talker, equal to the grey African parrot. Anyone walking near the aviaries in the London Zoo may hear himself addressed by the words " Salaam Sahib," "Achchha Sahib," and finding no one there is mystified as to where the voice came from.

The field mynah, *Acridotheres ginginianus*, is smaller bird than the brown mynah, slate-grey in colour, orange eyes with small black pupils, orange beak and legs, black head, wings and tail with white feathers in wings and tail. The breast is much lighter in shade than the back. It is thought to have been introduced from Burma but there is no definite proof of this at present. Formerly it was entirely a field bird, not going near any human habitation, but latterly it has lost much of its shyness and is to be found building its nest in the same places as the brown mynah. If necessary, it will peck away at wooden battens until there is a space large enough to allow it to squeeze its body through. It is principally insectivorous, feeding on crickets, grasshoppers, caterpillars, worms and even lizards and spiders; but in captivity it has been found to live on cooked meat, bread and cooked rice. Large numbers are to be seen in the fields following ploughs.

There is another species of mynah, seen usually at the break of the monsoon on the plains in Southern India, colloquially called the Brahminie mynah which is a sacred bird in parts of the Deccan, and is possibly *Eulabus religiosa*. It is much the same size as the grey mynah and is similar in every respect except that the colour is more of a fawn shade. It is essentially insectivorous and is to be seen following the ryots when ploughing and cultivating; it is timid and to the best of the writer's knowledge has never been found

nesting near human habitats, such as bungalows, go-downs or grass huts; nor has it been seen to frequent fowl-runs when food is put there. As far as one knows it has no bad habits or black marks against its name. The Brahminie mynah is essentially a field bird and farmers' friend; if more insectivorous mynahs are needed for introducting to other islands of the Fiji Group, it may be worth while to make further inquiries about this species.

NOTES ON CATCHING AND REARING THE GREY OR FIELD MYNAH (*Acridotheres ginginianus*) FOR TRANSPORT TO OTHER ISLANDS WITHIN THE FIJI GROUP.

MANY attempts have been made to catch and transport large numbers of these birds to Vanua Levu and other islands, but apparently with little success. The primary cause of failure was in taking the adult birds and the length of time that they were in captivity during transport. There is no doubt that catching the birds in their wild state, feeding them on food which has not been their natural diet, and imprisonment for several days was the cause of the total failure. Birds caught in their wild state and caged could have been successfully transported, no doubt, when there was an aeroplane service between the islands. There is no difficulty in catching the birds in reasonable quantities, either by netting them behind ploughs, or by setting a drop-net over the food usually given to the domestic fowls in their runs at eventide. For the grey mynah is generally to be found feeding with the common brown mynah (*Acridotheres tristis*) in the fowl yards. The drop-net is an enlarged adaption of the sieve trap: a reasonable size for such a trap would be a wooden frame 10 feet by 6 feet covered with a ½-inch mesh fishing or prawn net. Wire-netting should not be used as it is likely to bruise the birds when the sticks supporting the frame over the food or bait are pulled away, for it is necessary to weight the frame to cause it to fall quickly. Another method of catching the birds is by the light of an electric torch when they are roosting. This can be done by spotting the light on them and picking them off the branches by hand or by using a hand net about 12 to 18 inches in diameter similar to a butterfly net. All along the coast in the dry zone of Viti Levu are to be found numerous roosting places of both species in the young mangroves. Thousands of the birds roost on the islands of Vio and Bekana opposite Lautoka. The writer has not tried this method of trapping mynahs but has successfully done so with parrots, parroquets, pigeons and doves in Southern India.

The author was asked recently by the Acting Director of Agriculture to obtain grey mynahs for the island of Rabi, Vanua Levu, and knowing definitely that the taking and caging of the adult birds could only lead to high mortality—for by temperament they are shy and nervous but pugnacious—decided to make this mynah experiment: by taking the fledgings from the nests, putting them in cages and if the parent birds deserted to try and rear them by hand-feeding. It is thought generally that the grey or field mynah, unlike the brown mynah, does not build its nest in the house-roosts but that is certainly not the case in the Lautoka district where there were equally as many nests of the grey as of the brown bird. In fact the grey with its smaller body found it easier to squeeze between the battens that had been placed to prevent the birds building their nests beneath the iron roof. It has great determination for one can

but believe it was just those birds which had nested in the same place the year before who refused to be turned out from what they knew were desirable residences; after searching along the battens under the eaves for a space nearly high enough to admit them they set to work to peck away the wooden battens until a large enough space was made to allow them to enter. When the grey bird makes a comfortable entrance the brown takes advantage of his ingenuity. When the nests were raided for the fledglings it was discovered that six or seven nests were built in a row, and to each of these nesting places there was an entrance and an exit; for the birds, both brown and grey, were observed when building to fly to one entrance with twigs, grass or paper in ther beaks and leave the roof several yards or so further along by another hole. While persistently pecking their way in, they often caused the " boy " unnecessary journeys to the front or other doors of the house to answer the knocking of an importunate caller !

The young birds should be taken from the nests on a dull day or late in the afternoon as their sight is likely to be affected if taken from the darkness of the roof into bright sunshine. They should be removed when fully fledged and a few days or nearly a week before they would leave naturally. The time can be detected by the increased strength of their cheeping. To extract the birds it is necessary to lift up a sheet of the corrugated iron roofing. One nest of grey mynahs was found in a hole in a tree.

When the birds had been removed from the nests they were put in a cage hung not far away so that the parent birds should not lose sight of them. A suitable cage may be made from a whisky case with $\frac{3}{4}$ inch wire-netting fixed across the front. The size of the mesh is important because if the mesh is larger they will put their heads through it and strangle themselves; and if of $\frac{1}{2}$-inch or smaller gauge mesh, the parent birds cannot feed them. A small door is necessary at one end of the cage, also a draw tray made from a piece of kerosene tin or light gauge sheet iron to facilitate cleaning the cages, as the birds' excreta and any pieces of meat left over become very offensive; to facilitate cleanliness the tray needs a covering of sand. Two perches, placed so as to allow head clearance, are necessary and a piece of this wood or tin should be placed to overhang the top of the cage to form an eave as protection from sun and rain. In front of the cage nail a thin strip of wood to the underneath of the box to form a sill or shelf about 4 inches wide, for the parent birds to alight upon and feed their young. It was with much satisfaction that one observed the parent birds coming with food in their beaks for the imprisoned youngsters soon after they were put into the cage.

The writer, when undertaking the experiment of rearing the fledglings, naturally thought he would have to keep boys constantly looking for various grubs and insects for food. Fortunately the parent birds still considered themselves responsible and took an active interest in feeding the fledglings and so far have never deserted them, until the young birds can feed themselves. The parent birds continue to feed them for 35 days. After they have learnt to feed themselves birds should be transferred into a much larger cage to give them more freedom of movement.

The birds are insectivorous in their natural state, eating all kinds of grubs, caterpillars, worms, small lizards, spiders, crickets and grasshoppers; but they would not touch slugs, even if chopped up, or millipedes. In fact the parent birds would pitch on the sill, shrieking their shrill danger call if they saw millipedes in the cage; and millipedes left on the sill they would pick up and fly away with and drop. They did likewise with slugs, but the

slug is less obnoxious to them. After the birds had been a week or more in the cage, and the parents had shown no sign of deserting them, a little bread, rice and finely chopped cooked meat, also raw meat, were placed on the sill to discover what the parents would give them. The parents ate the raw meat themselves, but gave bread, rice and cooked meat to the youngsters also a very little cooked carrot, but any other cooked vegetables such as potatoes, onions and cabbage were discarded. A careful watch was kept to see which food was being given and which discarded. Any meat cooked with salt was not tried, as previous experience of the writer with other varieties of birds had proved that salt was not good for them. In order not to give the birds too sudden a change of food, after the parent bird stopped feeding them, for a week garden worms were given to them at evening; after they were given the meat, bread and rice mixture, (when the birds were 8 to 10 weeks old) garden worms were again given to them, but where not relished to the same extent; the surplus kept in a tin in earth for two days was not touched by them, and was rejected in every case. A point of interest is that when the parents fed the youngsters with worms that had been gathered and placed on the sill they immediately flew to the ground, picked up some grit or soil and fed this to the young ones. This gave another reason for covering the draw tray of the cage with sand, with a little ordinary road grit scattered on top. It has been noticed that the young birds will eat ants. These come into the cage for the scraps of food that are left and there are usually a number under the tray when the draw tray is removed upon which the birds feed with evident relish. The amount of food given to one cage of five birds was in the proportion of a large breakfast cup of crumbled bread and ½ a breakfast cup of rice mixed together. The birds were given their food at 7 a.m. and 4.30 p.m. At feeding time, fresh water must be given in a tin large enough for the birds to bathe in.

The biggest clutch taken from one nest was five; the eyes are almost black up to the fourth week when they turn to a bluish grey, eventually becoming orange with a black pupil. The adult cock bird is a little larger than the hens, a shade darker in colour and markings and has a slightly larger tuft at the base of the beak.

This bird is indigenous to Afganistan, the Himalayas and northern Central India.

CROP LIENS.

By
H. R. SURRIDGE, A.R.C.Sc. (I), B.Sc.

AGRICULTURE throughout the world is an industry largely in the hands of smallholders and peasant farmers; such is the case in Fiji although an exception to this are the operations of the Colonial Sugar Refining Company.

Amongst the many risks that have to be encountered and the problems that have to be faced by the agriculturalist, the two most important are probably those of weather and finance. For the type of agriculture here practised, weather is beyond our control, one season may " make " a farmer, the next " break " him, and this is a vital factor in the creation and sometimes the solving of the financial problem. Secondary industries have, as a rule, little difficulty in attracting sufficient capital from the public to enable them to carry on to the dividend paying stage. With agriculture the reverse applies, the general investor is not prepared to lend his money to an industry

which carries the element of risk of the kind met with in agriculture. The result of this attitude is that the farmer, particularly the small farmer, is often in need of ready cash so much so that in some countries it has been necessary to establish agricultural banks. Their prime function is to finance, at reasonable rates of interest, agricultural undertakings, the security to cover the advances being given in the form of land, buildings, stock, implements and crops, a mortgage or lien being taken out by the mortgagee according to the type of farming practised. The system of crop liens has been extensively developed in Fiji, the Colonial Sugar Refining Company particularly having used it as a means of enabling Indians and Fijians, whose only capital is the ability and will to work well, to translate such capital into ready cash by giving advances at low rates of interest against the sugar cane crop, the money being utilised for the purchase of stock, implements, fertilizers, &c., and recovered in whole or in part at harvest time. Such advances have proved of tremendous value to both the Company and tenant, resulting in a contented and industrious peasant farmer who has in most cases achieved the status of independence.

Such liens, however, are only granted to the tenants who are definitely farming and renting Company's land for cane which is growing under the direct supervision of the Company's European overseers, and according to their scheme of cultivation.

Outside the Company's jurisdiction, other conditions apply. In this case the granting of crop liens is generally in the hands of moneylenders, Indian and others, who often demand and secure abnormally high rates of interest on the security offered, irrespective of the race with which these people deal. The cost of preparation of such liens is of course a charge on the mortgagee and the result is too often that the mortgagee ultimately becomes the slave of the mortgagor owing to his inability to clear the heavy interest charges levied. Cases are on record of Fijians paying as much as £25 per acre for the preparation and planting of sugar cane. Other examples are to be found amongst native copra planters.

TWO USEFUL TREES.

By
W. L. PARHAM,
Agricultural Assistant.

1. AVOCADO PEAR

(*Persea americana Mill.*)

This fruit is well enough known not to require description in Fiji where the supply is unequal to the demand.

The tree is rather brittle, so a site sheltered from wind is advisable. A rich open soil is best.

On flat land it would be preferable to plough " lands " of the same width as the spacing apart of the rows of trees so that the rows may follow the summit of the " lands " and therefore be given good protection from surface water. Preparation of the land requires besides only the setting out and digging of the holes.

Spacing should be 20 feet at least and the holes should be 3 feet deep and 3 feet wide, the subsoil being thrown clear of the hole. It is an advantage to dig holes several months ahead to permit of weathering. In filling in, topsoil only should be used and a quantity of leafy vegetable matter buried with it.

As there is a choice of varieties it is recommended that in selection attention should be paid to thickness of pulp and to earliness and lateness so as to give a longer season. For a commercial orchard uniformity is very important. Propagation may be by budding, grafting or inarching but the small grower will probably rely on seedlings.

Fresh seed is essential and should be from well-formed fruits from selected trees. Sowing is best done in bamboo pots and only quick germinating and robust plants should be retained. By splitting away the sides of the bamboo pots at planting, the seedlings may be set intact in place by sliding them out of the pots. In planting it is very necessary to allow for subsequent subsidence of the soil owing to the large hole dug originally.

The plants must be kept clear of weeds, particularly grass. Mulching with dead vegetation is very helpful.

On the average the trees bear in five years.

The fruit should be picked when fully formed but still firm.

Careful handling is necessary and careful packing if the fruit is to be transported any distance.

---

2. ANNATTO.

(*Bixa orellana* L.)

The annatto is better known in Fiji by its vernacular names of "qisa" or "rerega," though the latter is also applied to tumeric (*Curcuma longa L.*) The scarlet tissue covering the seeds has caused the bush to be termed the "paint-tree" by some Europeans. From being utilised by the natives as facial paint this colouring material is now being used instead for colouring soap.

Annatto is in demand abroad for the colouring of butter and cheese and requests have been received for supplies from Fiji.

The plant forms a compact bush and is being grown as hedges and along fences. It appears very hardy on a wide range of soils, in both the wet and dry zones.

Fresh seed is essential and should be broadcast in a nursery bed, and with light shade and regular watering very good germination is obtained. Seed is obtainable from wild plants until August and if sown then the plants are ready for planting out in the wet season.

In about six weeks from sowing it is advisable to remove the seedlings from the seed-bed to nursery lines where at spacings of about one foot the plants can harden off.

If advantage is taken of rainy weather, planting out can be done with no more than a loosening up of the soil but the plant should be given the best start possible.

Maintenance is limited to a few weedings and the mulching of the young plants with dead vegetation. Topping of the plant to give uniformity of height and compactness is advisable. The first crop may be expected in three years and bearing lasts about three months.

Harvesting is simplified by pruning the branches, which bear capsules, when these are almost ripe. The capsules require drying by exposure to the sun on mats or a tarpaulin. As the capsules dry and burst the seeds and colouring matter are removed and dried again.

The present demand is for dried seed. The price obtainable in Fiji may not exceed 2d. per lb but grown as suggested above sales may be regarded as all profits, expenses being chargeable to the plant's maintenance as a live-fence.

DERRIS IN MELANESIA.

By
R. J. A. W. LEVER.

PRACTICALLY every recent agricultural journal published by the various Colonial Dependencies has a reference of some kind to derris as an insecticide. A few notes on the known species occurring in Oceania may therefore prove of local interest, as planters and others who might be prone to take up its cultivation will then know the position.

The local species referred to by Seemann (1) as *D. uliginosa* Benth. is said to occur from Tonga through Melanesia to the East Indies and south-east Africa, but this last locality is possibly too wide a range. It is interesting to note that its native name in Fiji and the Solomons, " duva," is " tuba " in the Malay language.

Blackie (2), still using the same specific name, showed that its " derrid content " or ether extract was only about one-sixth as much as the Malayan *D. elliptica*, a fact which is apparent to the Fijians, who prefer this imported form. The rotenone (active principle) was only one-fourteenth as great (0·3 per cent. compared with 4·5 per cent.) as the best commercial samples.

In 1934, Pagden (3) and (4), made experiments on small fish with a Solomon Islands species, which he stated was closely related to the very toxic Malayan *D. malaccensis*, but was subsequently determined as D. *trifoliata* Lour., which name has priority over *D. uliginosa* Benth.

The best samples sent to the Rothamsted Experimental Station, Harpenden, England, were found on analysis (5) to contain rotenone equal in strength to one-sixth of the Malayan *D. elliptica* while the weakest samples were less than one-twentieth as powerful.

More recently Milsum (6), working on specimens of *D. trifoliata* from tidal rivers and mangrove swamps in Malaya, shows it to have a rotenone content about one-eighth, and an ether extract one-sixth, as strong as *D. malaccensis* and its root is considered to be of insufficient toxicity to be of any commercial value. However, an unknown species from New Guinea (7) has satisfactory amounts of rotenone compared with *D. elliptica* and this is the nearest source to Fiji whose species is therefore weak compared with Malayan forms.

---

(1) Seeman, B., 1865–73.—*Flora Vitiensis.*
(2) Blackie, W. J., 1932.—Agricultural Journal, Fiji, Vol. 5, No. 1.
(3) Pagden, H. T., 1934.—British Solomon Islands Agricultural Journal, Vol. II, No.1, January.
(4) Pagden, H. T., 1934.—*Ibid.*, Vol. II, No. 4, October.
(5) Lever, R. J. A. W., 1935.—*Ibid.*, Vol. III, No. 2, April.
(6) Milsum, J. N., 1938.—Malay Agricultural Journal, No. XXVI., No. 1.
(7) Bulletin of the Imperial Institute, 1933, Vol. XXXI, No. 4.

THREAD BLIGHT OF COCONUT.

By
R. J. A. W. LEVER.

Coconut leaflets may frequently be seen, particularly in poorly drained areas, covered with a mass of silvery white threads which are the absorptive hyphæ functioning as roots. This fungus was first described from New Ireland in 1921 as *Corticium penicillatum* Petch and was later mentioned by Simmonds (1)—though said not to have been named—from New Britain, the Solomon Islands, New Hebrides and Fiji.

In 1936 the writer took specimens from Vella Lavella, British Solomon Islands to the Imperial Mycological Institute, Kew, where they were determined, after comparison with type material, as this same species of *Corticium*.

In his excellent review of coconut diseases, Dwyer (2) mentions that this fungus has been observed only on New Ireland and New Hanover, but later in the paper states it is serious on Bougainville Island, Northern Solomons.

The purpose of this note is to show that this disease is much more widespread in the Pacific than has been assumed and that its determination has been known for some seventeen years.

Nothing more is apparently known about control than the draining of affected areas and collecting and burning of affected leaves, mentioned in the first paper quoted.

(1) Simmonds, H. W., 1925.—Bulletin No. 16, Department of Agriculture, Fiji.
(2) Dwyer, R. E. P., 1937.—New Guinea Agricultural Gazette, Vol. 3, No. 1.

EXEMPTED FIJIANS.

By
W. L. PARHAM.
Agricultural Assistant.

In Regulation No. 4 of 1938, one of several new amendments to Native Regulations, it is stated:—"Any District Commissioner may exempt any native from the provisions of this Regulation or of any other Regulation of Provincial Council or District Council relating to the performance of services for common or individual benefit."

In brief, the amendment means a short cut to exemption from communal duties for any Fijian who has good cause to appeal to the District Commissioner. The obstacles to a Fijian readily obtaining such exemption by application to his own people are so many and involved that the right to a ready appeal is a great gain. This is not to say that opposition to an exemption is necessarily hostile. For instance the reason may be that the applicant has a hereditary deciding vote in the councils of his people who oppose his leaving the commune on the grounds that he cannot be spared. This may be only a form of extreme politeness.

Of course it is natural that many Fijians fear that wholesale exemptions mean detribalisation. The danger exists but the remedy is to facilitate the settling on his own land of the exempted Fijian. The Department of Agriculture has made, and is continuing to make, special efforts in that work and results already encourage one to believe that the change may come smoothly and to the benefit of the Fijian without sacrifice of his many admirable customs.

However, in this article it is intended to discuss particularly the importance to the European land-holder of the exempted Fijian. It is astonishing to find much hasty criticism of the exemption of Fijians by Europeans who may be expected to benefit by the diminishing of obstacles to their gaining reliable labourers. Although it certainly is not intended that a Fijian should become exempted merely to become a hired labourer, it cannot be overlooked that the self-reliant peasant provides the best type of seasonal agricultural labourer. The advantages to all concerned of the "intermixture of races and types of agriculture" is fully discussed by Willis,* and it should suffice here to remind European and Indian land-holders of the importance to them of an increasing population of free small-holders who can readily be drawn upon for casual labour. Any employer of natives in Fiji can recall many instances of the disadvantages of depending upon the services of Fijians whose time is not at their own disposal. Observation of the results of numerous exemptions in agricultural districts incline one to the opinion that employers should direct some of their attention to this amelioration of their difficulties rather than to concentrate on the hope of immigrant labour. For example, in one province eighty youths were exempted provisionally to be instructed in practical agriculture: in addition to maintaining their own cultivations these Fijians earned useful money ploughing for Indians who quickly availed themselves of the opportunity to employ trained men.

To generalise, it should not be excessive to hope for a steady increase of exempted Fijians established on their own holdings and evincing an improved responsibility in their business undertakings. The ideal of the planter relying on the local rural population for labour may not appeal to those imbued with the idea of "signing-on" labourers *en masse*, but it should appeal to those who find it possible to depend on local free labour.

**Agriculture in the Tropics*, Part IV, by J. C. Willis, Cambridge, 1922.

THE GIANT TOAD—DISTRIBUTION, DIET AND DEVELOPMENT.

By
R. J. A. W. LEVER.

THE giant toad, *Bufo marinus* (L.), was introduced into Fiji in 1936 from Hawaii by courtesy of the Hawaiian Sugar Planters' Association and with the co-operation of the Colonial Sugar Refining Company. This amphibian is frequently called the "Surinam toad" but it is not restricted to Dutch Guiana as it occurs from southern North America to South America and also in Trinidad and Tobago (1). From French Guiana (Cayenne) it was first introduced to Martinique, then to Barbados, Jamaica (1844), Bermuda, Puerto Rico (1920 from Barbados and 1924 from Jamaica), Hawaii (1932) and thence to the Philippines (1934), Formosa (1935), Queensland (1935) and Fiji. Local distributions have been made in many parts of the main island of Viti Levu, also on Vanua Levu, Taveuni, Rabi and Kadavu, the last by the Agricultural Officer South, who also supplied the writer with a colony of toads and tadpoles for Colo East.

Since notes on the local diet appeared (2), the author has examined three more individuals, one kindly forwarded by Mr. H. W. Simmonds, O.B.E. The first had the following stomach-contents of animal origin:—2 red millipedes, 1 slug, 1 Noctuid (?) caterpillar, 3 species of ants, 2 dragon flies, 1 *Geotomus* (Pentatomid) and 1 Tenebrionid beetle. The second had only one weevil, *Orochlesis* sp., and some pond weed. The third toad contained 5 small snails, 4 large ants, 1 cockroach and vegetable remains. The weevil *Elytroteinus subtruncatus* Frum. has also been found in the stomach. It would be interesting to know if the rose-beetle *Adoretus* bulks largely in the diet as it was partly to control this insect that the introduction was made. However, quite enough toads are being killed at night by motor cars to prohibit the deliberate dispatch of any more for post-mortem examinations.

Simmonds (3) records the tadpole stage as being about 17 days and elsewhere as 12 to 17 days. A record by the Agricultural Officer South (Mr. H. R. Surridge) makes the period about 23 days and this is confirmed by the present writer who kept tadpoles under observation from hatching for 24 days. In Puerto Rico (4) the period is two months and in Hawaii (5) 25 to 30 days: the differences in time are attributed to the abundance and kind of food, variations in temperature and laboratory conditions.

When in Trinidad in 1929, the writer found large ticks on the backs of these toads, which have been determined by the British Museum authorities as *Amblyomma disimile* Koch. So far no parasites have been recorded in Fiji.

An eel (*Anguilla* sp.), seen in a small creek in Suva, was killed by the writer with a walking stick and the stomach found to contain the femora and bones of the hind feet of a young toad, indicating another predator besides the "top minnow" which also feeds on this amphibian.

REFERENCES.

(1) Leonard, M. D., 1933.—*Jour. Econ. Entom.*, Vol. 26, No. 1.
(2) Lever, R. J. A. W., 1937.—*Fiji Agric. Jour.*, Vol. 8, No. 4.
(3) Simmonds, H. W., 1937.—*Ibid.*, No. 3.
(4) Sein, F., 1937.—*Jour. of Agric.* of *University of Puerto Rico*, Vol. XXI, No. 1.
(5) Pemberton, C. E., 1934.—*Hawaiian Planters' Record*, Vol. XXXVIII, No. 3.

VETERINARY NOTES.

BREEDING STOCK IMPORTED DURING 1938.

THE following breeding stock have been imported to date in 1938:—

Cattle.—Milking Shorthorn, 1 male and 13 females; Friesian, 1 male and 2 females; Brahmin (Zebu), 10 males and 14 females.

Horses.—Thoroughbred, 1 female.

Pigs.—Middle White, 3 males and 2 females; Large White, 3 males; Berkshire, 1 female.

Sheep.—Corriedale, 20 females.

Poultry.—4 turkeys, 13 ducks and 126 fowls.

The addition of these valuable animals to the breeding stock of the Colony will be of great benefit and importers are to be commended on their enterprise.

The Brahmin or Zebu cattle have been imported by the Colonial Sugar Refining Company from United States of America, the breeder, Mr. G. D. Hudgins of Hungerford, Texas, being one of the most prominent Brahmin breeders in America. There is no doubt that the efficiency of the Colony's working stock will be greatly benefited by the introduction of these excellent animals.

Milking Shorthorns have been imported by Mr. R. M. Mackay of Navua and the Colonial Sugar Refining Company, while the Methodist Mission are responsible for the introduction of the Friesian cattle, which are intended for their Agricultural School at Navuso.

Importations of pigs have been made by Mr. Livingston of Navua, the Fiji Pastoral Company, the Methodist Mission, Mr. E. Corbett of Lautoka and the Colonial Sugar Refining Company.

Mr. A. H. Witherow of Waila has imported a nice looking and well-bred thoroughbred mare, whilst poultry have been imported by Messrs. Connelly, H. H. Ragg, C. Livingston, Jang Hing Loong, J. Cronin and Mrs. Gaspard.

Mr. J. P. Bayly of Nawai is the importer of the Corriedale sheep. He intends these for the improvement of his flock already at Nawai and deserves success for his persistent efforts to establish the sheep-breeding industry in Nadroga.

—H.W.S.

THE ABSENCE OF TUBERCULOSIS AMONGST ROTUMAN CATTLE.

During the periodical visit to Rotuma of an officer of the Veterinary Division during 1937, the tuberculin test was applied to 221 head of the cattle population which numbers 314. There was no sign of reaction to the tuberculin test among the animals tested nor was there any clinical evidence of tuberculosis in any of the remainder of the stock. It is, therefore, reasonable to assume that the cattle of Rotuma are free from this disease.

Practically all the stock in Rotuma are descended from cattle imported from Fiji and it is still the custom for cattle to be imported from the Fiji Group, particularly Taveuni. As bovine tuberculosis is not uncommon in the two main islands and Taveuni, the absence of the disease in Rotuma presents an interesting feature.

—H.W.S.

SINGLE OX YOKES.

Everyone is familiar with the method of working bullocks in pairs in agricultural operations in Fiji. At times however, it may be more convenient to work a single bullock only. This may be necessary where only one bullock is available or where it is required to cultivate between rows of crops.

When a single bullock is harnessed to an agricultural implement a single yoke, a pair of trace chains and a swingle-bar are required.

There are several types of single bullock yoke, of which the following are short descriptions:—

The inverted horse collar.—Since the neck of the bullock is broader above than below, a suitable horse collar can often be made to fit a bullock by placing it up side down around the neck.

The properly constructed bull neck yoke, in the form of a collar. These are much used on the Continent of Europe. They are more expensive however, and none are at present available in Fiji.

The forked tree branch.—This is a home made yoke. A suitable forked branch is fashioned to the shape of the neck with the fork resting on top of the neck. The two ends on the fork are joined under the neck with a cord. Hooks or rings are fitted to the sides of the fork at a convenient height for the attachment of the trace chains. In this type the trace chains pull to closely over the shoulders.

The single yoke.—A naturally curved piece of timber is obtained about twenty inches long and with a cross section measurement of 4 inches broad by 5 inches deep. The curved centre of the yoke fits over the nape of the neck. The yoke is held in position by an ordinary iron bow, of $\frac{3}{4}$-inch iron in the same manner as in the double ox yoke. Ring bolts of $\frac{1}{2}$-inch iron for the attachment of the trace chains pierce the yoke about 3 inches from the ends, the rings being downward. The edges of the yoke are nicely rounded to prevent injury to the skin of the ox. The width of the curve fitting the top of the neck should be about 8 inches at the shoulders. The trace chains are connected behind the ox, to the ends of a swingle bar. Hooks are fitted to the bar for this purpose. The bar itself is attached at the centre to the object to be drawn. The advantage of this type of yoke is that the trace chains are held well out from the body of the ox by the projecting arms of the yoke. The yoke is perhaps best fashioned from a piece of naturally curving vau tree (*Hibiscus tiliaceus*). Such material is usually to be found without much difficulty and the work can easily be done by natives and Indians in their own homes.

The poll yoke.—In Germany and some other countries bullocks are harnessed for single traction by means of a yoke which fits across the front of the poll beneath the horns. Hooks are fitted at each end of the yoke to which the trace chains are attached. The yoke is usually made of hard wood shaped to fit the poll. Better quality yokes are fitted with leather covered padding.

—C.R.T.

EXTRACTS.

THE MEDITERRANEAN FRUIT-FLY IN PALESTINE.

The following extracts from an article by A. Gruenberg in the Bulletin of Entomological Research (Vol. 29, Part 1., March, 1938), should be of interest to local citrus growers who have to contend with the Fiji fruit-fly, *Chætodacus passifloræ* Frogg., whose habits are similar to the Mediterranean fruit-fly:—

"Fruits containing living larvæ are transported from one place to another, thus helping the fly to establish itself in all areas of the country; this is the most important means of spread, but one almost impossible to check. Citrus growers used to throw damaged fruits into the Jordan River, contributing in this way to the dissemination of the fly in the valley; but this practice ceased entirely after the danger of it has been explained . . . . .

"The development of fruit-fly during the season 1937 proved again that no fruits should be left on the trees in the Jordan Valley during April, even in years of exceptionally low infestation. The same remark relates to scattered fruits left by growers after the completion of the main picking season, and negligence displayed in this respect is a contributing factor in the spread of the pest . . . . .

"The value of preventive measures has often been emphasised. The life-history of the fruit-fly clearly indicates the importance of destroying dropped and infested fruits; such fruits should be destroyed by boiling, burning or burial in soil; in the last case the fruits should be buried deep enough (2 inches) to prevent emergence of the adults, which display a remarkable ability to force their way through incredibly small openings. It is advisable to add some lime to the soil, which should be well tamped."

EXCERPT FROM "SCIENCE IN INDIA".

According to Sir Thomas Holland, among the sciences of economic value entomology perhaps ranks first in importance to India. Sir Mirza Ismail has drawn a very gloomy picture of the conditions in India. More than one hundred million people suffer from malaria every year and more than one million succumb to its effects. "The debility, poverty and apathy caused by the disease are factors of magnitude in retarding the national, social and economic progress of the country." *Anopheles* brought about the decay of the Greek and Roman civilizations, and is to-day one of the major obstacles to progress in India. According to Fletcher, the sugar-cane pests alone cause an annual loss of 300,000,000 rupees.* The hide industry of India suffers a yearly loss of 1·5 crores† of rupees from one insect—ox warble fly. At a very modest computation, the annual loss caused to India by insects has been put at 200 crores‡ of rupees, and a loss of more than a million and half of human lives. It is a truism that insects have been responsible for more destruction of property and loss of life than that caused by all the wars, floods, earthquakes, fires and famines in human history, and the losses caused by them are on the increase. Advancing civilization is producing conditions most suitable for insect multiplication and spread.

—*Nature*, Vol. 141, No. 3564, Feb. 19th, 1938.

---

* 300 million rupees is approximately £20 million sterling.
† 1·5 crores, or 15 million rupees, equals £1,120,000.
‡ 200 crores is about £130 millions.

EXTRACT FROM "THE CROWN COLONIST," APRIL, 1938.

NYASALAND.

Crayfish to prevent dysentery.—About 500 young fresh-water crayfish, the gift of the Madagascar Government to the Nyasaland Government, recently arrived by air in the Protectorate. The 300 which survived the journey have been placed in streams near Zomba. Madagascar's virtual freedom from two of the principal scourges of East and Central Africa—amœbic dysentery and bilharzia—is believed by scientists to be due to the fact that the crayfish in the river feed voraciously on the snails which play an important part in the life of cycle of the dysentery amœba and the bilharzia fluke worm. The crayfish have already become acclimatised. When well established they will be distributed to other rivers and streams in the Protectorate.